other changes, its salinity then increasing by evaporation. Brackish springs are common in the vicinity, and these, with the salts of the feeding streams, still contribute to the accumulation of saline matter. On the authority of the United States Geological Survey, the present rate of accumulation will charge the lake with common salt within a period of 25,000 years. The present density is about 1·168, while that of the ocean is but 1·025. It appears that it is not the nature of the saline materials, but their excessive quantity alone, that makes the water unfit for ocean life; for the relative proportions of the solids in solution do not differ materially in the lake-water and sea-water. Three-fourths of these solids are common salt in both cases. The lake, while strongly salt, is not alkaline, and would presumably support the higher organisms of the ocean if properly diluted. Diatoms have been grown experimentally in the diluted Salt Lake water, and, indeed, have been found native in the lake, together with other low plant and animal life, in its brackish parts.

On account of the removal for commercial purposes of large quantities of salt, many have looked forward to a day when the consequent freshening process shall have reduced the density of the water sufficiently to make it an inhabitable medium. About 42,000 tons of common salt are removed annually, while 16,000 tons, according to the calculation of the 25,000 year period required to saturate the lake, enter it each year. From the present density, 1·168, the lake must now hold about 400,000,000 tons of salt, and with these figures as a basis, it appears that in 14,000 years—the processes continuing at the present rate—the lake-water will reach the density of sea-water. As this is a far cry into the future, some would believe that the solution of the problem was to be found in acclimatisation of marine forms to the present briny waters. There is no evidence that this is feasible or remotely possible; the oyster has the best possible opportunity to adapt itself to salt or fresh water, but clings to an intermediate brackish zone of a density between 1·010 and 1·020. The plan which seemed to offer the only possibility of success concerned the oyster, and the location, near the mouths of the fresh streams that feed the lake, of water-zones of a degree of brackishness favourable to oyster growth. The conditions which were found to exist were such as to show conclusively that there is no hope for the utilisation of the lake in this way. The favourable zones, which are narrow at best—in no case over three hundred yards—are subject to great fluctuations in position due to the wind and to seasonal changes. The variation in the volume of water carried by the inflowing streams is remarkable. In one of them the ratio of the greatest flow to the least was as 28 to 1. When they are flushed with the melting of snow in spring the oyster zone is carried lakeward, and during the period of minimum flow in autumn it travels up the mouth of the stream in which it is located. The wind alone sometimes makes a change of level of several feet, and a consequent change of density from 1·009 to 1·014 within five minutes has been observed. Moreover, the deltas of the streams, which must of necessity be the location of the oyster beds, are subject to deposits of silt in amounts fatal to oysters. All these conditions in conjunction make the difficulties of successful oyster culture insuperable.

The brackish springs characteristic of the Bonneville bed have a low density, none exceeding 1·005, and suggest a plan by which they might be utilised. By making them the sources of artificial ponds the evaporation, which is greater than the rainfall, would raise the density to the desired point at which it could be maintained by a proper regulation of the brackish inflow and outflow. On a commercial scale, however, the experiment would be expensive, and might or might not justify itself.

PAUL KNUTH.

Born on November 20, 1854, Paul Erich Otto Wilhelm Knuth, Professor at the Oberrealschule of Kiel, was only in his forty-sixth year at his death on October 30. After graduating at Griefswald in 1876, he was engaged in teaching at Iserlohn in Westphalia, and from 1881 at Kiel. His first scientific investigations were in the realm of organic chemistry, his chief works a Handbook of Flower-Biology, a Flora of Schleswig-Holstein, and a series of short papers upon the botany of the islands off the German coast—Rügen, Heligoland, Sylt, &c.

The "Handbuch der Blütenbiologie" is based on the English edition of Hermann Müller's "Befruchtung der Blumen," and is destined to replace it. Increasing knowledge has swelled the literature-list from 825 entries to 2871, and Knuth's plan allowed for three volumes in the place of the single one issued in English in 1883; of these the last, designed to contain all we know of the fertilisation of flowers in lands outside Europe, remains unpublished. There is hope that the work may yet be completed. Knuth's own observations in Java, Japan, and California, made in 1898 and 1899, were made to add to the rather meagre knowledge available for this unpublished volume.

His observations on the flora of the North Friesian Islands, of Heligoland and of Rügen, demonstrate how the winds that blow over sea-girt islets, inimical to insect life, impose a limit to the distribution of plants whose highly specialised flowers need insect aid for their fecundation. The lesser the island the greater the influence. Rügen is large, and it is not evident; the Halligen are small, and it is very apparent. These Halligen are "low-lying, marshy islets, hardly rising more than a metre above high tide, wind-swept, where one wanders hour after hour without taking a single anthophilous insect, save on the rare hot and windless days which coax a few to fly from flower to flower." On them the high-types of floral development are rare.

His Flora of Schleswig-Holstein, named above, was largely a compilation, intended to supply a real need, and was followed by a History of Botany in the double province. These, however, as the first steps towards his botanical work, have their own interest. I. H. B.

NOTES.

Some particulars concerning the vessel which is being built at the Howaldt Shipbuilding Yard at Kiel, for the German Antarctic expedition, are given by the Berlin correspondent of the *Times*. The ship will be built of wood, the only material strong and elastic enough to resist the pressure of the ice. In form she will be somewhat rounder than the *Fram*, and will not fall away towards the keel in the same manner. The length of the ship will be about 46 metres, the breadth between 10 and 11 metres, and the draught about 5 metres. She will be constructed to carry coal and other stores sufficient for three years, and will contain accommodation for five scientific observers, five officers, and a crew of about twenty men. Each of the observers, and each of the officers, will have his own cabin. The centre of the ship will be occupied by the rooms for scientific work, and the forecastle will contain space for fifty Arctic dogs. The ship will be rigged as a three masted schooner. Two steam winches will serve the anchor and will also be used for scientific purposes. The ship will be illuminated throughout with electric light. The Howaldt Shipbuilding Yard, which is under a contract to have the ship built by May 1, 1901, and fitted out not later than the end of August, 1901, has already begun the construction. A model of the vessel will be shown at the Paris Exhibition.

THE *British Medical Journal* states that the Italian Parliament has voted a sum of 1,300,000 lire for the erection of new buildings in the University of Bologna. The work will be begun next spring.

WE learn from the *Times* that M. Raphael Bischoffsheim has presented to the Paris University his observatory at Nice worth 2,700,000f., and 2,500,000f. the interest of which is to cover its expenses.

M. T. Ribot, professor of psychology at the College de France, has been elected a member of the Paris Academy of Moral Sciences in succession to the late M. Nourrisson.

GENERAL GALLIENI, Governor of Madagascar, has been elected a correspondant of the Paris Academy of Sciences. The Academy has also elected M. Méray as correspondant of the section of geometry, and M. Rosenbusch as a member of the section of mineralogy.

A SPECIAL correspondent of the *Times* reports: "six Marconi wireless telegraphy instruments intended for the Boers have been captured at Cape Town. The experiments at Orange River have been highly successful. The communication with De Aar, seventy miles distant, is perfect."

MR. C. VERNON BOYS, F.R.S., will deliver the first of a course of six Christmas lectures specially adapted for young people, at the Royal Institution this afternoon. The subject will be "Fluids in Motion and at Rest" (experimentally illustrated). The remaining lectures will be on December 30 and January 2, 4, 6, 9, 1900.

THE two astronomers whose names have been submitted to the French Minister of Public Instruction, who will select one to fill the vacancy in the Bureau des Longitudes caused by the death of M. Tisserand, are M. Radau and M. Bigourdan.

AN exhibition of food, clothing, medicines, and other articles suitable for travellers in uncivilised and unhealthy regions of the globe, will be held at St. Martin's Town Hall, Charing Cross, on January 1–5, under the title of the "Livingstone Exhibition." A loan collection of Livingstone relics and of objects of interest connected with the work of other travellers will be on view.

AN interesting account of experiments on the growth and regeneration of the tails of tadpoles, conducted by means of Born's method of grafting, is given by Mr. R. G. Harrison in the October number of the *Bulletin* of the Johns Hopkins Hospital. In the neighbourhood of Baltimore there occur two species of frogs whose embryos differ so markedly in colouration from one another, that in any case where parts derived from each are united by grafting into a single organism it is easy to follow in the living specimen, as development proceeds, the change in position of any group of cells in respect to the original line of section. During the development of the tail after grafting it was noticed that a remarkable shifting of the epidermis over the underlying organs took place; so that after a time the epidermis properly belonging to the tail was restricted to the terminal third of that appendage. Now it is well known that the cutaneous nerves of the trunk and tail of the full-grown larvæ and frogs, in passing from the vertebral column to their termination in the skin, pursue an oblique course; and this is obviously due to the above-mentioned backward shifting of the epidermis. Certain other interesting features were also brought to light in the course of the experiments.

WITH the view to ascertain what displacement, vertically or horizontally, took place in the Khási and Gáro Hills during the Indian earthquake of June 1897, a revision of the principal triangulations in the district was made by officers of the Survey of India Department during 1898, and the results are referred to in the report just issued. Horizontal and vertical observations were taken at thirteen stations, fixing the positions of twenty-two and the heights of twenty-five old stations, embracing an area of 1020 square miles. The results show that the whole of this area lay within the region affected by the earthquake, so it is impossible to state how much any one station has been displaced in comparison with the unaffected area outside, but apparently all have suffered more or less. The average horizontal displacement appears to be about 7 feet, whilst the changes in height vary from a subsidence of 4·3 feet to an upheaval of 24 feet; these, however, for the reasons already mentioned, cannot be considered as absolute, but only relative changes. The general apparent effect is that the area has been both widened and raised. If possible, the revision work should be continued and extended, with instruments of equal calibre to those employed in the original triangulation; for accurate measurements of the movement of the earth's crust due to a large earthquake are of deep scientific interest.

THE Antiquity of Man in America is an important problem, and it is well that Mr. W. H. Holmes should revise, as he has done in the *American Anthropologist* (N.S., I., 1899, p. 614), the evidence relating to Auriferous Gravel Man in California. He discusses this special aspect of the question in a full, lucid and judicial spirit. His conclusion is that the testimony furnished is greatly weakened by the facts (1) that the finds on which it was based were made almost wholly by inexpert observers, and (2) that all were recorded at second hand. Affidavits cannot redeem it. Nothing short of expert testimony, amply verified and vigorously stated, will convince the critical mind that a Tertiary race of men, using symmetrically-shaped and beautiful implements, wearing necklaces of wampum and polished beads of marble or travertine bored accurately with revolving drills, fishing with nets weighted with neatly-grooved stone sinkers, and having a religious system so highly developed that at least two forms of ceremonial stones had been specialised, occupied the American continent long enough to develop this marked degree of culture without leaving numerous and distinctive traces of its existence. All these objects resemble modern implements in every essential respect. They are such as may have fallen in the mines from Indian camp sites or been carried in by the Indians themselves.

AN article upon electrolytic processes in industrial operations, contributed to the *Engineering Magazine* by Dr. W. Borchers, shows some of the remarkable developments of electro-technology during late years. Descriptions are given of the various processes by which industrial products are obtained electrolytically. The Castner process for manufacturing sodium is well known, and several similar devices have recently been introduced. Magnesium is obtained from melted magnesium salts by a process founded upon Bunsen's investigations. For the production of aluminium, the Pittsburg Reduction Company use a mixture of chlorides and fluorides of the metals of the alkalis and alkaline earths as electrolytes and solvent for the aluminum oxide. Copper, nickel, silver, and gold, in so far as electrolysis may be said to be applicable to them, are chiefly obtained in pure form by electrical means from the crude metal produced by the smelter. Gold is also electrolytically deposited from weak solutions obtained by chemical lixiviation processes. Caustic soda, caustic potash, chlorate of potash, and chlorine are obtained by electrolysis from aqueous alkali-chloride solutions. By suitable appliances and working conditions, the chlorine and caustic alkali solution may be carried off separately to produce chloride of lime and solid caustic soda, or they may be made to form a solution of chlorate of potash in the place of caustic potash and chlorine. The methods by which these and other electrolytic products are obtained are briefly described by Dr. Borchers in his interesting paper.

WE have received from Dr. L. Carnera, Voluntary Assistant at the Royal Observatory of Turin, a discussion of the amount of bright sunshine recorded at that Observatory, showing *inter alia* the mean duration of sunshine during the different hours and months of the years 1896–8, together with a comparison with the means obtained in a discussion by Dr. Rizzo of the values of the previous six years. While the variations between the two series show that the period is much too short for the deduction of trustworthy means, the results are valuable owing to the comparative rarity of this important climatic factor; for although observations of barometric pressure, temperature, &c., have been made at that institution for more than a century, a sunshine recorder has only been in use there for the last ten years. In fact, the instrument has only come into general use during the last twenty years, principally owing to improvements made by Sir G. G. Stokes in a recorder devised some years previously by the late Mr. J. F. Campbell.

THE Government Astronomer of Western Australia has sent us a copy of the meteorological observations made at the Perth Observatory and other places in that colony during the year 1898. This is the second of a series of annual publications issued by the Perth Observatory; annual meteorological reports have been published since 1876, but the new series shows a marked improvement. In past years the observers were dependent solely upon written instructions without inspection, and had to find out how to do their duties as best they could. In addition to the usual observations, a set of four Platinum Resistance thermometers have been sunk to various depths at Perth, and daily weather forecasts are now issued, which, on the whole, have been remarkably successful. In the year 1898 there were 31 stations provided with barometers and other instruments, and 213 rain-gauge stations, but the monthly charts show that large tracts are still unrepresented.

THE U.S. Government is pushing on its researches of the economical resources of Porto Rico. *Bulletin* No. 25 of the U.S. Department of Agriculture (Division of Forestry) consists of a report by Mr. Robert F. Hill, of the U.S. Geological Survey, on the forest conditions of the island. He states that the climate and soil are well adapted to the growth of a large number of trees and shrubs of great economical value, and he advocates a reversal of the deforesting policy pursued by the Spaniards. Besides those valuable for timber and constructing purposes, he names, as specially adapted to the climatal conditions, the tamarind, the papaw, the castor-oil plant or "palma Christi," the all-spice, the lime, a large number of edible fruits, as the orange, citron, lemon, guava, anona, mango, banana, and many others whose names are less known in this country. The coffee cultivated is of a superior quality. There are comparatively few harmful animals or poisonous plants.

PROF. W. B. SCOTT (*Trans.* Wagner Free Inst. of Science Philadelphia, vol. vi.) describes and figures a series of Ungulate Mammals from the Uinta and White River formations (Oligocene) of Utah and Colorado in North America. The mammals belong to the sub-order of "Selenodont Artiodactyls," and they include two groups; the first comprises forms generically identical with, or clearly related to, Old World anthracotheres and true ruminants, which reached the American continent by migration; the second group includes forms indigenous to America, the successive stages of whose descent may be traced through several of the Tertiary formations.

THE ninth volume of the Iowa Geological Survey (1899) contains the Annual Report for 1898, with accompanying papers. Statistics of mineral productions, including coal, clay, stone, lead and zinc, are contributed by Mr. S. W. Beyer. There are also reports on the Counties of Caroll, Humbolt, Story, Muscatine, and Scott, accompanied by colour-printed maps, and followed by an account of the Artesian Wells of the Belle Plaine Area. The county reports contain concise accounts of the various formations including Silurian, Devonian, Carboniferous, Cretaceous, Pliocene, Glacial and more recent deposits, together with notes on their economic products. In Muscatine county the Devonian rocks afford many points of special interest, and they have yielded a number of fossils.

THE *Mittheilungen* of the Vienna Geographical Society contains an excellent abstract of a paper by Dr. Eduard Richter, published by the Swiss Geological Society at the end of last year, on the advance and retreat of the glaciers in the Alps during the Ice Age. Dr. Richter arrives at the important result that the variation of climate was probably much smaller than has been supposed, because the resistance to the outflow of the ice increases with its quantity in a rapid ratio, and the level of the snowfields would therefore rise quickly to levels where the temperature was lower. The variations of level due to this cause would themselves give rise to sudden and irregular changes in the glaciers according as the ice-surface rose above, or fell below, the snow-line. They also account for the enormous amount of moraine detritus carried by these glaciers; each was made up of a large number of small ice-streams, and the debris was not carried as a ground moraine, but in the body of the ice.

THE *Biologisches Centralbatt* for November 1 contains an article by Dr. L. Kathariner on the influence of light on the colours of the pupæ of butterflies, in which many interesting points are recorded.

THE following lectures will be delivered at the Royal Victoria Hall, Waterloo Road, S.E., on Tuesday evenings during January:—January 2: "Chronicles of a Clay Cliff," by W. H. Shrubsole; January 9: "A Peep Behind the Scenes," by Metcalfe Wood; January 16: "Birds at Home and Abroad," by Mrs. Lemon; January 23: "Plants of Long Ago," by A. C. Seward, Esq., F.R.S.; January 30: "The Fathers of Geology," by F. W. Rudler.

THE *Journal* of the Franklin Institute for December contains several additional addresses delivered on the occasion of the recent celebration of the seventy-fifth anniversary of the Institute. Dr. C. F. Himes describes the history of photographic discovery from the time of Daguerre and Niépce; Mr. C. Kirchhoff surveys the achievements in mining and metallurgy during the past three-quarters of a century; and Mr. J. Fritz gives some reminiscences of the development of iron manufacture in the United States in the same period.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN JANUARY, 1900.

January 2–3.	Epoch of January meteors (radiant 230° + 53°).
3.	4h. Venus in conjunction with the moon (Venus 6° S.).
6.	7h. 12m. to 8h. 10m. Occultation of 19 Piscium (mag. 5·2) by the moon.
8.	17h. 32m. Jupiter's Sat. IV. in conjunction N. of planet.
10.	7h. 1m. to 7h. 59m. Occultation of τ^2 Arietis (mag. 5·2) by the moon.
10.	7h. 55m. to 9h. 1m. Occultation of 65 Arietis (mag. 5·6) by the moon.
11.	10h. 27m. to 11h. 34m. Occultation of κ^1 Tauri (mag. 4·6) by the moon.
11.	10h. 40m. to 11h. 23m. Occultation of κ^2 Tauri (mag. 5·5) by the moon.